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etching the underlying layer by way of a resist pattern, to thereby form a fine pattern in the underlying layer.

REMARKS

Claims 1-5 are pending. The Office Action mailed October 3, 2001 has been reviewed and the Examiner's comments carefully considered.

The drawings were objected to by the Examiner as failing to comply with 37 C.F.R. § 1.84(p)(5) for failing to include certain reference signs mentioned in the specification. Applicants propose amending the drawings by way of a Request for Approval of Drawing Changes submitted herewith.

The title of the invention was objected to as not being descriptive. Applicants have amended the title to recite, "Method of Forming a Fine Pattern Using a Silicon-Oxide-Based Film, Semiconductor Device with a Silicon-Oxide-Based Film and Method of Manufacture Thereof.". Withdrawal of the objection to the title is respectfully solicited.

Claims 1 and 4 were objected to for particular informalities cited by the Examiner. Claims 1 and 4 have been amended by non-narrowing amendments to correct the informalities.

Claims 1-5 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter of the invention. Claims 1-5 have been amended by non-narrowing amendments where appropriate and are now in condition for allowance.

Claims 1-5 were rejected under 35 U.S.C. § 102(b) as being anticipated by Cheung et al. (EP 0 840 361 A2). The rejection is respectfully traversed for the following reasons.

Cheung et al. teach use of a "low nitrogen content layer (e.g., a silicon oxide layer)" directly underneath a chemically-amplified photoresist layer to prevent deterioration of the geometry of the photoresist layer which is thought to be caused by the presence of nitrogen atoms. However, as explained in the prior art discussion on page 2 of the present application, applicants found that deterioration of the geometry of the photoresist layer may still occur even where the presence of nitrogen atoms is reduced as taught in Cheung et al. The experiments conducted by the applicants demonstrate a dramatic reduction in deterioration of photoresist layer geometry when

the nitrogen content of the surface of the silicon-oxide-based film is 0.1 atm.% or less. A semiconductor device having a pattern on the order of 0.1 μm can be fabricated and the present invention can be usually preferably applied to formation of a pattern of 0.18 μm or less, as described on page 9, lines 26 to 29 of the specification. This is contrary to what would be expected, which would be a gradual change. This unexpected result is clearly demonstrated in Tables 1, 2, and 3 of the present application.

Cheung et al. does not teach or suggest that there is a level of nitrogen content above which deterioration of the photoresist layer remains problematic. The applicants' experiments surprisingly demonstrate that deterioration of photoresist layer geometry still occurs where the nitrogen content of the surface of the silicon-oxide-based layer exceeds a critical level. The present invention's limitation concerning the critical range of surface nitrogen content is neither taught nor suggested by Cheung et al.

In view of the foregoing, it is respectfully urged that the present claims are in condition for allowance. An early notice to this effect is earnestly solicited. Should the Examiner have any questions regarding the application, the Examiner is invited to contact the undersigned at the telephone number provided below.

Respectfully submitted,

Date: 3/29/02

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Claims:

1. (Amended) A method of forming a fine pattern, comprising the steps of:

forming a silicon-oxide-based film [on a] over a substrate [directly or by way of another layer];

forming a chemically-amplified photoresist layer on the silicon-oxide-based film; and

transferring a mask pattern onto the chemically-amplified photoresist layer upon exposure through a mask; wherein, in the step of forming the silicon-oxide-based film, a nitrogen content of the surface of the silicon-oxide-based film is made to [assume] about a value of 0.1 atm.% or less.

2. (Amended) The method of forming a fine pattern according to claim 1, wherein the silicon-oxide-based film is deposited at a temperature of 400°C or more by means of [the] a plasma CVD technique.

3. (Amended) The method of forming a fine pattern according to claim 1, wherein a step of exposing [the] a surface of the silicon-oxide-based film to plasma atmosphere of O_2 or N_2O is added between the step of depositing the silicon-oxide-based film and the step of forming the chemically-amplified photoresist layer.

4. (Amended) A semiconductor device comprising:

a substrate; and

a silicon- oxide-based film which is formed [directly on] over the substrate [or on the substrate by way of another layer]; in which nitrogen content of an upper boundary area of the silicon-oxide-based film [assumes] is about a value of 0.1 atm.% or less.

5. (Amended) A method of manufacturing a semiconductor device, comprising the steps of:

forming a silicon-oxide-based film over [on] an underlying layer [directly or by

way of another intermediate layer], a [the] surface of the silicon-oxide-based film having a nitrogen content of 0.1 atm. % or less;

forming a chemically-amplified photoresist layer on the silicon-oxide-based film;

transferring a mask pattern onto the chemically-amplified photoresist layer upon exposure through a mask; and

etching the underlying layer by way of a resist pattern, to thereby form a fine pattern in the underlying layer.